Problem 3.9: Cartesian to Polar Conversion

Convert the following expressions into polar form. Plot their location in the complex plane.

1. $(1+\sqrt{-3})^2$
2. $3+j^4$
3. $\dfrac{2-j\frac{6}{\sqrt{3}}}{2+j\frac{6}{\sqrt{3}}}$
4. $\left(4-j^3\right)\left(1+j\dfrac{1}{2}\right)$
5. $3e^{j\pi}+4e^{j\frac{\pi}{2}}$
6. $\left(\sqrt{3}+j\right)2\times\sqrt{2}e^{\left(j\frac{\pi}{2}\right)}$
7. $\dfrac{3}{1+j3\pi}$

Problem 3.10: The Complex Plane

The complex variable z is related to the real variable u according to

$$z=1+e^{ju}$$

- Sketch the contour of values z takes on in the complex plane.
- What are the maximum and minimum values attainable by $|z|$?
- Sketch the contour the rational function

  $$\frac{z-1}{z+1}$$

  traces in the complex plane.

Problem 3.11: Cool Curves

In the following expressions, the variable x runs from zero to infinity. What geometric shapes do the following trace in the complex plane?

1. e^{jx}
2. $1+e^{jx}$
3. $e^{-x}e^{jx}$
4. $e^{jx}+e^{j\left(x+\frac{\pi}{4}\right)}$